CHAPTER 6

SEWER PIPE MATERIALS, FITTINGS AND JOINTS

6-1. General.

Factors which will be considered in the selection of sewer pipe materials and piping systems are:

—Flow characteristics or friction coefficient.
—Life expectancy and history of use.
—Resistance to scour and abrasion.
—Resistance to acids, alkalis, high temperature or corrosive wastes, and corrosive soils.
—Ease of handling and installation.
—Physical strength.
—Joint watertightness and ease of installation.
—Availability of pipe in required sizes, strengths, etc.
—Availability of fittings, connections and adapters.

No pipe manufactured is suitable for all sewer installation requirements and conditions. The pipe materials covered in this chapter are the ones most often used for sanitary and industrial waste sewers. Each type of pipe will be evaluated to determine its suitability for the particular design. Where iron or concrete pipe are to be considered, special attention will be paid to subsurface and soil conditions. The characteristics of the soil in which a pipe is placed affect the rates of corrosion, with the most corrosive soils being those having poor aeration and high values of acidity, electrical conductivity, dissolved salts, and moisture content. The relative potential for corrosion may be estimated by evaluating the degree of corrosion of existing metallic or concrete pipelines previously buried in the soil. Facility engineer personnel will normally have knowledge of these matters and should be consulted. When this information is not available, or is non-conclusive, resistivity tests of the soil will be conducted and results evaluated as required in TM 5-811-4 or AFM 88-45. Pipe materials found inappropriate for use will be deleted from the project specifications. For Air Force facilities, standard ASTM or AWWA pipe specifications for the various pipe materials set forth below can be found in AFM 88-15.

6-2. Ductile iron.

a. Ductile iron (D.I.) pipe is utilized for sewers requiring a high resistance to external loading, a high degree of toughness and ductility. It is well suited for most sanitary sewers including river crossings, piping at wastewater treatment facilities, pipe located in unstable soils, highway and rail crossings, water line crossings, depressed sewers and piping aboveground. However, the use of D.I. pipe is limited somewhat by a susceptibility to corrosion from wastewaters containing acids, and from aggressive soils. D.I. pipe will normally be cement lined, and can be provided with a bituminous coating inside or a polyethelene lining. Exterior bituminous coatings are standard, and where soil is extremely corrosive, a polyethelene encasement may be required.

b. Pipe is available in diameters 3-inch through 54-inch, and in 18- or 20-foot laying lengths. Allowable trench and superimposed surface loads for D.I. pipe are computed and tabulated in ANSI A21.50. The ordinary range of loadings can be met without special bedding materials and procedures. The Handbook of Ductile Iron Pipe, Cast Iron Pipe published by the Cast Iron Pipe Research Association (CIPRA) will be referenced for guidance in designing and installing ductile iron pipe.

6-3. Cast iron soil.

a. Cast iron soil (C.I.S.) pipe will normally be allowed only as an option for building connections. C.I.S. pipe is used primarily for building interior drainage, waste and vent piping, as described in Chapter 1 of the Cast Iron Soil Pipe & Fittings Handbook published by the Cast Iron Soil Pipe Institute. C.I.S. pipe is resistant to internal and external corrosion when provided with a bituminous coating, and is not subject to abrasion from grit, sand or gravel.

b. C.I.S. pipe is available in 2-inch through 15-inch diameters, in 5 and 10 foot laying lengths, and is manufactured in service (SV) and extra heavy (XH) classifications. Pipe joints will be either compression type using rubber gaskets, or bell and spigot type calked with lead and oakum. Structural design of C.I.S. pipe will be in accordance with the methods outlined in Chapter 5 of the Cast Iron Soil Pipe & Fittings Handbook, with special emphasis given to external loadings and pipe strength.

6-4. Vitrified clay.

a. Vitrified clay (V.C.) pipe is manufactured from clay and shale products to form an ideal material for sewer use. V.C. pipe has a high resistance to corrosion from acids and alkalies, and resists scouring and erosion well. This provides a distinct advantage in serving as industrial waste sewers, or sanitary sewers subject to hydrogen sulfide generation. It should be noted that availability of some sizes and strength classifications is limited in certain geographical areas. V.C. pipe is also known for brittleness.

b. Clay pipe is available in nominal diameters 4-inch through 42-inch, and laying lengths of 1 to 10 feet. Clay pipe is manufactured in Standard and Extra

Strength classifications. The Clay Pipe Engineering Manual, which is published by the National Clay Pipe Institute, provides engineering data to be used in designing clay pipe sewers.

6-5. Concrete.

a. Concrete sewer pipe is appropriate for applications requiring large diameter sizes or high strength characteristics. Care should be taken when specifying concrete pipe to assure that it is suitable for the environment in which it will be installed. Type II A cement, as specified in ASTM C 150, is sufficient for most installations. Type I may be used in certain situations where less than 0.1 percent soluble sulfates (SO_4) occur in the soil, or the wastewater contains less than 150 mg/L sulfates. If the soil contains more than 0.2 percent water soluble sulfates, or the wastewater sulfate concentration exceeds 1000 mg/L, Type V cement will be required. Unlined concrete pipe is subject to scouring by wastewaters carrying grit and sand at high velocities.

b. Reinforced concrete (R.C.) pipe will be used where high external loadings are anticipated, and large diameters or tight joints are required. The advantages of R.C. pipe include a wide range of diameters, 12-inch through 108-inch, and laying lengths, 4 feet to 24 feet, which are available. A disadvantage is the lack of corrosion resistance to acids, especially critical where hydrogen sulfide is generated in substantial quantities. However, special PVC or clay liner plates, coatings of coal-tar, coal-tar epoxy, vinyl, or epoxy mortar can be applied to the pipe for corrosion protection. Non-reinforced concrete sewer pipe is generally available in diameters 4-inch through 30-inch, and in minimum laying lengths of 3 feet. Concrete pipe joints are either bell and spigot type using o-ring gaskets, or tongue and groove type made with cement mortar or bituminous mastic. Design of concrete sewers will be in accordance with the Concrete Pipe Handbook by the American Concrete Pipe Association.

6-6. Asbestos-cement.

a. Abestos-cement (A.C.) pipe is made from a mixture of asbestos fibers and portland cement. A.C. pipe matches the durability of concrete pipe but weighs less, and is manufactured in a wide variety of strength classifications and laying lengths. A.C. pipe will deteriorate in a corrosive environment of hydrogen sulfide, acid wastes or aggressive soils, however some degree of protection can be provided with plastic linings. A.C. pipe material allowed for sewers will be limited to Type II as specified in ASTM C 500.

b. For gravity sewers, A.C. pipe is manufactured in numerous strength classifications. The class designation refers to the minimum three-edge bearing test strength in pounds per lineal foot of pipe. Lower strength classes are generally available in diameters 8-inch through a maximum of 30-inch, and higher classes in diameters 10-inch through 42-inch. Laying lengths normally are 10 and 13 feet. Joints are made with couplings employing rubber ring gaskets.

6-7. Polyvinyl chloride (PVC) plastic.

a. PVC pipe is chemically inert to most acidic and alkaline wastes, and is totally resistant to biological attack. Since it is a nonconductor, PVC pipe is immune to nearly all types of underground corrosion caused by galvanic or electrochemical reactions, in addition to aggressive soils. Durability, light weight, a high strength-to-weight ratio, long laying lengths, watertight joints and smooth interior surfaces are characteristics which make PVC pipe an attractive alternative for use in sewer systems. Disadvantages include possible chemical instability due to long-term exposure to sunlight, excessive pipe deflection under trench loadings when installed improperly or subjected to high temperature wastes, and brittleness when exposed to very cold temperatures.

b. PVC sewer pipe is available in diameters 4-inch through 24-inch, and in laying lengths of 10 to 20 feet. Pipe dimensions comply with the standard dimension ratio (SDR) system, which means that mechanical properties are constant without regard to pipe sizes. Joints are integral bell and spigot type, and utilize elastomeric gaskets.

c. PVC pipe must be installed to provide continuous passive lateral soil support along the conduit, and the completed installation must be tested for diameter deflection. Manufacturers' design manuals, in addition to the Uni-bell Plastic Pipe Association's Handbook of PVC Pipe-Design and Construction, will be utilized in checking deflection, backfilling and trench loads. Allowable pipe deflections will be indicated in the project specifications.

6-8. Acrylinitrile-butadiene-styrene (ABS) plastic

a. ABS composite plastic pipe.

(1) ABS composite pipe consists of two concentric thermoplastic tubes integrally connected across the annulus by a truss—like bracing. The annular void space is filled with portland cement concrete, or other suitable material, to form a bond between the inner and outer tubes. ABS composite pipe is termed a "semi-rigid" pipe because it resists deflection better than most other plastics. The pipe is light in weight, and resists attack by acids, alkalies and biological growths.

(2) ABS composite pipe is available in diameters 8-inch to 15-inch, and in one laying length of 12.5 feet. ABS pipe is joined by either socket type molded fittings, which are solvent fused to the pipe, or by

means of mechanical seal couplings utilizing 0-ring gaskets. The solvent welded joints minimize the possibility of poor joint construction, and greatly reduce groundwater infiltration. Manufacturers' design and installation manuals will be used for selecting pipe embedment, backfill and compaction requirements.

b. ABS solid wall plastic pipe. ABS solid wall plastic pipe is manufactured from the same compounds as composite pipe, however the pipe wall is of one solid material. The pipe is available in diameters 3-inch through 12-inch, and has the same jointing as composite pipe; however, it does not match the stiffness of composite pipe.

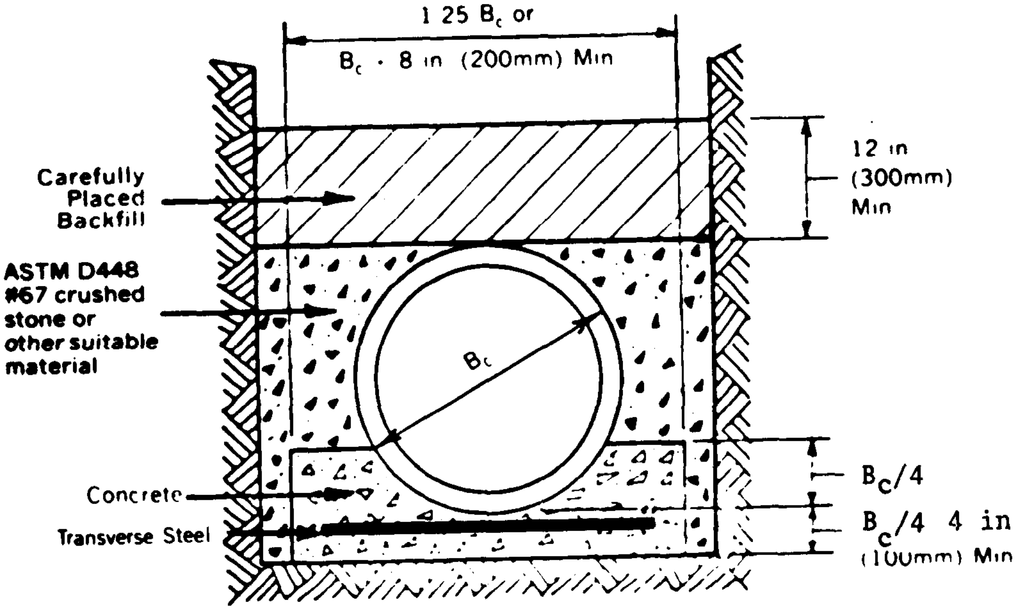
6-9. Reinforced plastic mortar (RPMP).

b. RPMP sewer pipe is composed of a siliceous sand aggregate reinforced with glass fibers, and embedded in a thermosetting polyester resin. RPMP pipe is ideally suited for large diameter applications, and performs extremely well in resisting pipe wall deflection and internal/external corrosion. The unique fiberglass/resin construction provides optimum protection against attack from wide range of chemically aggressive environments including hydrogen sulfide and other sewer gases, most natural soils, salt and brackish water, and galvanic or electrolytic reactions. No special coatings or cathodic protection are required. Even though RPMP pipe is officially designated a flexible conduit, its structural integrity is such that for most installations, the trench preparation and backfill requirements are considerably less than with other flexible conduits, and even some rigid ones. Its other advantages include light weight and a smooth, glass-like interior surface.

b. RPMP sewer pipe is available in diameters 8-inch through 144-inch, and in laying lengths of 10, 20 and 40 feet. Joints are bell and spigot type utilizing 0-ring gaskets. Manufacturer's design and installation manuals will be used for guidance in selecting appropriate trench and backfilling procedures.

6-10. Special materials.

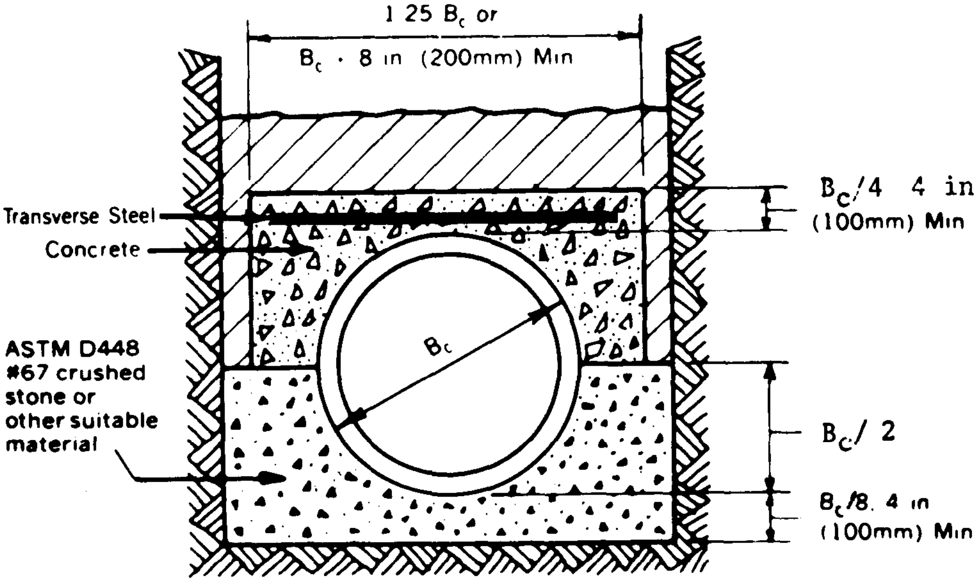
In designing sewer systems for military industrial installations, pipe and appurtenances made of materials which are subject to attack by acids, alkalies or high temperature, highly corrosive industrial type wastewaters, will not be included in the specifications. The designer will carefully evaluate the particular wastes involved, and will indicate in the specifications the types, concentrations, and temperatures of the various waste materials to be encountered. Conditions seldom exist at military installations requiring discharge of acids, or other type wastes, in such concentrations that vitrified clay pipe would not be suitable. However, there may be situations where extremely corrosive wastes preclude the use of V.C. or other pipe materials covered in this manual. For these occasions, special pipe materials, linings, or coatings will be selected using manufacturers recommendations, and any other applicable publications. Laboratory certification of pipe or material performance may be required in cases of unusual wastes.



Load Factors: 2.8 Plain concrete
3.4 Reinforced concrete p=0.4%*

$$p = \frac{\text{area of steel}}{\text{area of concrete (at invert)}}$$

(a) Class A-I

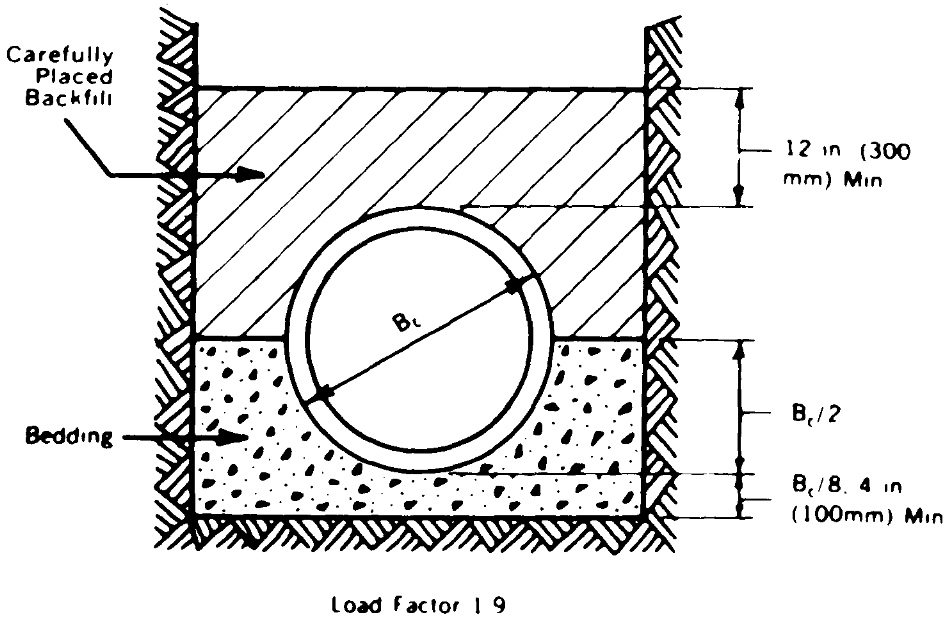


Load Factors: 3.4 Reinf. conc., p 0.4%
4.8 Reinf. conc., p - 1.0%

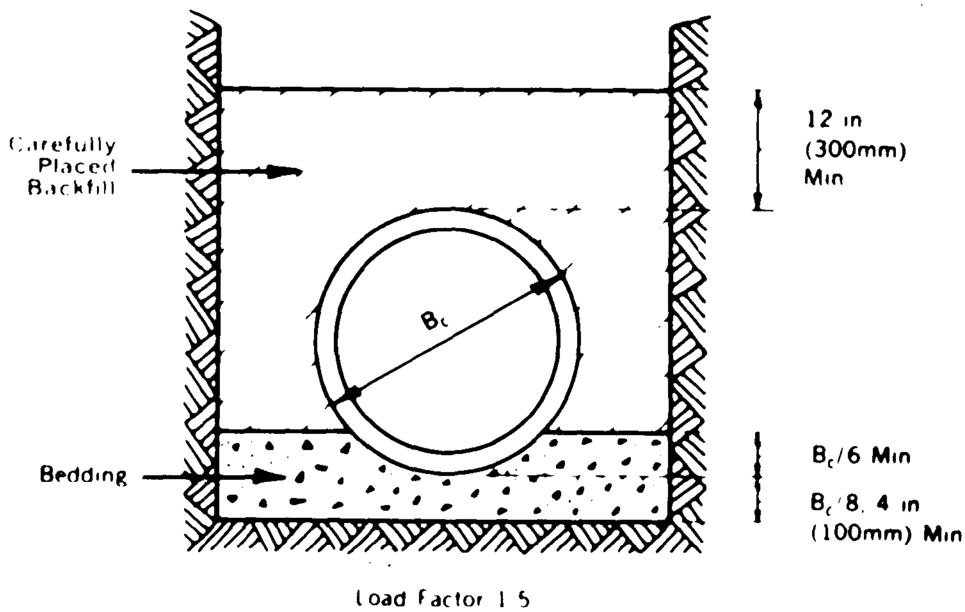
(b) Class A-II

Source: Clay Pipe Engineering Manual by National Clay Pipe Institute, July 1982, p. 52

Figure 5-2. Load factors and class of bedding. (sheet 1 of 3)



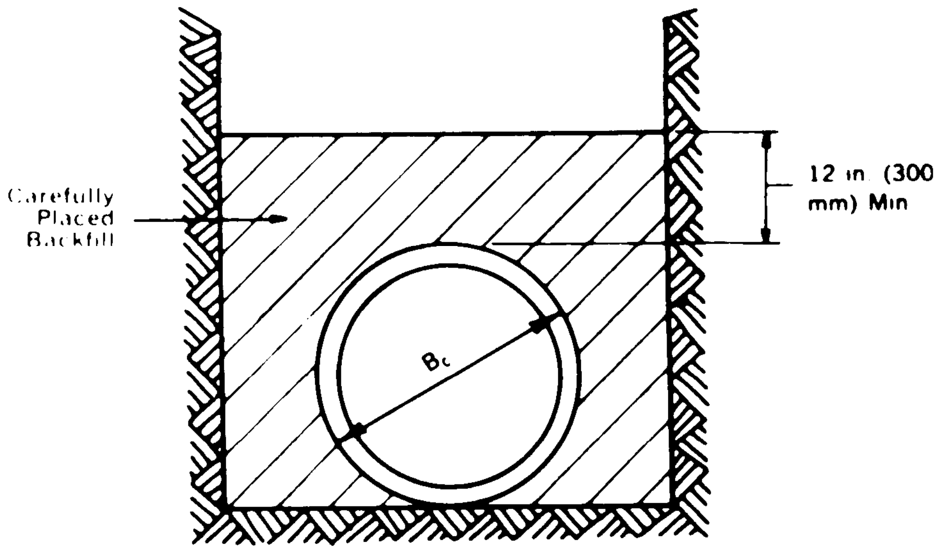
(c) **Class B**



(d) **Class C**

Figure 5-2. Load factors and class of bedding. (sheet 2 of 3)

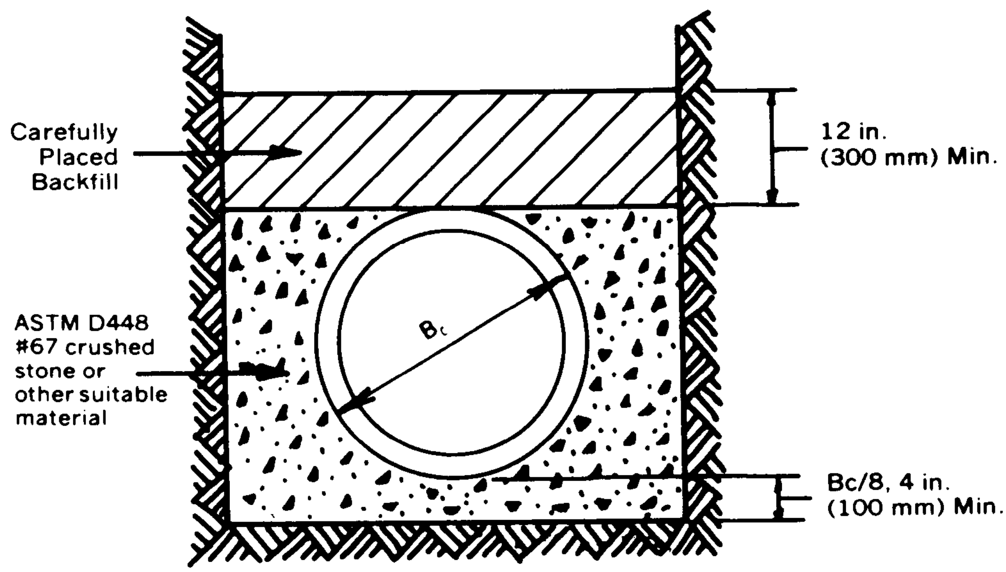
f. Design guidance. The methods and procedures described in WPCF Manual of Practice No. 9 for designing sewer installations in unsatisfactory soil, rock, embankments, and by tunneling, jacking, boring, etc., will be adopted. Sewer piping installed in areas subject to earthquake damage will include seismic design as required by TM 5-809-10/AFM 88-3, Chapter 13. Cold region facilities will be designed in accordance with TM 5-852-5.



Load Factor 1.1

Flat or restored trench bottom

(e) **Class D**



Load Factor 2.2

(f) **Crushed Stone Encasement**

Figure 5-2. Load factors and class of bedding. (sheet 3 of 3)

APPENDIX A

REFERENCES

A-1 *Government Publications*

a. Department of the Army and Air Force.

TM 5-809-10/ AFM 88-3, Chapter 13	Seismic Design for Buildings
TM 5-810-5/AFM 88-8, Chapter 4	Plumbing
TM 5-811-4	Electrical Design: Corrosion Control
TM 5-814-2/AFM 88-11, Chapter 2	Sanitary and Industrial Wastewater Collection—Pumping Stations and Force Mains
TM 5-814-3/AFM 88-11, Volume 3	Domestic Wastewater Treatment
TM 5-814-8	Evaluation Criteria Guide for Water Pollution Prevention, Control and Abatement Programs
TM 5-852-5	Arctic and Subarctic Construction: Utilities

b. Department of the Air Force.

AFM 88-45	Civil Engineering Corrosion Control—Cathodic Protection Design
AFM 88-15	Criteria and Standards for Air Force Construction

c. U.S. Environmental Protection Agency (EPA).

Technology Transfer Office, 26 West St. Clair Street, Cincinnati, OH 45268

Process Design Manual for Sulfide Control in Sanitary Sewerage Systems (1974)

A-2. *Nongovernment Publications.*

American Concrete Pipe Association, 8320 Old Court House Rd, Vienna, VA 22180

Concrete Pipe Handbook (1981)

American National Standards Institute (ANSI) Dept. 671, 1430 Broadway, New York, NY 10018

A 21.50—1976	Thickness Design of Ductile-Iron Pipe.

American Society of Testing Materials (ASTM) 1916 Race St., Philadelphia, PA 19103

C 150-81	Portland Cement
C 500-79a	Asbestos-Cement Pipe

Cast Iron Soil Pipe Institute, 1499 Chain Bridge Rd., McLean, VA 22101

Cast Iron Soil Pipe & Fittings Handbook (1976), Revised 1979

Cast Iron Pipe Research Association (CIPRA), 1301 West 22nd St., Oak Brook, IL 60521

Handbook of Ductile Iron Pipe, Cast Iron Pipe (1978)

National Clay Pipe Institute (NCPI), 350 W. Terra Cotta Ave., P.O. Box 310, Crystal Lake, IL 60014, 14700 E. Firestone Blvd., La Mirada, CA 90638, 1015-15th St. NW, Suite 804, Washington, DC 20005

Clay Pipe Engineering Manual (1982)

Uni-Bell Plastic Pipe Association, 2655 Villa Creek Drive, Suite 150, Dallas, TX 75234

Handbook of PVC Pipe—Design and Construction (1977, 1979)

Water Pollution Control Federation (WPCF), 2626 Pennsylvania Avenue NW, Washington, DC 20037

Manual of Practice No. 3	Regulation of Sewer Use (1975)
Manual of Practice No. 9	Design and Construction of Sanitary and Storm Sewers (2nd ed., 1970)

APPENDIX B

EXAMPLE PROBLEMS

1. Design 1 mile of interceptor sewer serving a military installation with the following populations and industrial discharges.

20,000 residents living on the installation (100 gpcd—Table 3-1)

6,000 nonresidents or employees coming from off-post and working 8-hour shifts (30 gpcd—Table 3-1)

Peak industrial flowrate = 1.0 mgd

Allow for an infiltration rate of 1000 gpd/in/mi.

Domestic Flows

20,000 × 100 = 2,000,000 gpd = 2.0 mgd

6,000 × 30 = 180,000 gpd = 0.18 mgd

total average daily flow = 2.18 mgd

Use a 24-hour basis since waste load is from the entire installation, and 92 percent of total is generated by residents.

Extreme peak flowrate

$R = 3.8/(2.18)^{0.167} = 3.34$

3.34 × 2.18 = 7.28 mgd

Peak diurnal flowrate = 1/2 × 7.28 = 3.64 mgd

Infiltration Allowance

Assume a 30-inch sewer

1000 × 30 × 1 = 30,000 gpd = 0.03 mgd

Design Flows

Extreme peak = 7.28 + 0.03 + 1.0 = 8.31 mgd

Peak diurnal = 3.64 + 0.03 + 1.0 = 4.67 mgd

Average daily = 2.18 + 0.03 + 1.0 = 3.21 mgd

Typical Sewer Design

Try a 30-inch sewer on a 0.10 percent slope (n = 0.013)

Flow depths and velocities

Q = 8.31 mgd	d/D = 0.80 < 0.90 (Para. 3-2) V = 3.0 fps	
Q = 4.67 mgd	d/D = 0.53	V = 2.7 fps > 2.5 fps
Q = 3.21 mgd	d/D = 0.43	V = 2.5 fps > 2.0 fps

Critical depths

Q = 8.31 mgd	dc/D = 0.48 < 0.80	
Q = 4.67 mgd	dc/D = 0.36 < 0.53	Flows are sub-critical
Q = 3.21 mgd	dc/D = 0.30 < 0.43	

2. Design 2000 feet of main or trunk sewer serving a large portion of the above installation with the following facilities.

Family Housing

500 units with 1800 residents (500 × 3.6 at 100 gpcd—Table 3-1)

Commercial Buildings

10 offices with 700 nonresidents, or employees from off-post, working 8-hour shifts (30 gpcd —Table 3-1)

Elementary School

500 students for 8 hours per day, 200 of the students live in the area and 300 are nonresidents (30 gpcd—Table 3-1)

Laundromat

50 machines—open 12 hours per day (500 gpd/machine is a typical allowance)

Domestic Flows

Resident 1800 × 100 = 180,000 gpd on a 24-hour basis

Nonresident (700 + 300) × 30 = 30,000 gpd on an 8-hour basis

Note that the nonresident population includes office workers and students who do not live in the area.

total average daily flow = 210,000 gpd

Use a 24-hour basis since wastes are from a large area on the installation and 85 percent is generated by residents.

Extreme peak flowrate

$R = 38.2/(210,000)^{0.167} = 4.93$

4.93 × 210,000 = 1,035,300 = 1.04 mgd

Peak diurnal flowrate = 1/2 × 1.04 = 0.52 mgd

Industrial Flow

Laundromat

50 × 500 = 25,000 gpd over 12 hours

Peak flowrate = 50,000 gpd = 0.05 mgd

Infiltration Allowance

Assume a 12-inch sewer

1000 × 12 × (2000/5280) = 4545 gpd = 0.005 mgd

Design Flows

Extreme peak = 1.04 + 0.005 + 0.05 = 1.095 mgd

Diurnal peak = 0.52 + 0.005 + 0.05 = 0.575 mgd

Average daily = 0.21 + 0.005 + 0.05 = 0.265 mgd

Typical Sewer Design

Try a 12-inch sewer on a 0.35 percent slope (n = 0.013).

Flow depths and velocities

Q = 1.095 mgd d/D = 0.68 < 0.80 (para. 3-2) V = 2.9 fps

Q = 0.575 mgd	d/D = 0.46	V = 2.5 fps = minimum
Q = 0.265 mgd	d/D = 0.30	V = 2.0 fps = minimum

Critical depths

Q = 1.095 mgd	dc/D = 0.55 < 0.68	
Q = 0.575 mgd	dc/D = 0.40 < 0.46	Flows are subcritical
Q = 0.265 mgd	dc/D = 0.26 < 0.30	

3. Design 1000 feet of lateral sewer for a small tributary area on the above installation with the following flows.

Offices

2 buildings with 100 employees working 8-hour shifts (30 gpcd is a typical allowance)

Theater

300 seats—open 10 hours per day (3 gpd/seat typical allowance)

Shop

30 employees working 8-hour shifts (30 gpcd is a typical allowance)

No industrial wastes

Domestic Flows

Offices, Theater and Shop

100 × 30 = 3000 gpd over 8 hours

300 × 3 = 900 gpd over 10 hours

30 × 30 = 900 gpd over 8 hours

total average daily flow = 4800 gpd

Use an 8-hour basis since tributary area is small and all occupants are short term.

Average hourly flowrate = 4800/8 = 600 gph

Extreme peak flowrate

$R = 22.5/(600)^{0.167} = 7.73$

7.73 × 600 = 4637 gph

Peak diurnal flowrate = 1/2 × 4637 = 2319 gph

Infiltration Allowance

Assume an 8-inch sewer (minimum size).

1000 × 8 × (1000/5280) = 1515 gpd = 63 gph

Design Flows

Extreme peak = 4637 + 63 = 4700 gph

Diurnal peak = 2319 + 63 = 2382 gph

Average hourly = 600 + 63 = 663 gph

Typical Sewer Design

Try an 8-inch sewer on a 3.0 percent slope (n = 0.013).

Flow depths and velocities

Q = 4700 gph	d/D = 0.20	V = 3.5 fps
Q = 2382 gph	d/D = 0.13	V = 2.7 fps > 2.5 fps
Q = 663 gph	d/D = 0.05	V = 2.0 fps = minimum

Critical depths

Q = 4700 gph	dc/D = 0.29 > 0.20*
Q = 2382 gph	dc/D = 0.20 > 0.13*

*Note that supercritical flow will result here. The critical slope equals 0.65 percent. However, a slope of 3.0 percent is required to produce the minimum velocity of 2.0 fps. Considering that the sewer is of minimum size, and that a flatter slope is not feasible if adequate velocity is to be provided, supercritical flow would be justified in this case.

4. Design a short lateral sewer to serve a battalion headquarters area with 5 companies, each consisting of 100 men. Facilities include a 500 man barracks complex, administrative offices, motor pool and mess hall. During the normal 8-hour workday a total of 300 people work in the area, 100 residents (out of 500 total) plus 200 nonresiding officers, NCO's and civilian employees. No industrial wastes are generated. A per capita allowance of 50 gpd from Table 3-1 will be used for the barracks buildings, and 30 gpcd is a typical allowance for office and shop workers.

Domestic Flows

300 × 30 = 900 gpd on an 8-hour basis

500 × 50 = 25,000 gpd on a 16-hour basis

total average daily flow = 34,000 gpd

Compute average hourly flowrates

For 8 hours – 9000/8 = 1125 gph

For 16 hours – 25,000/16 = 1563 gph

Use the 1563 gph as the average hourly flowrate

Extreme peak flowrate

$R = 22.5/(1563)^{0.167} = 6.59$

6.59 × 1563 = 10,300 gph

Peak diurnal flowrate = 1/2 × 10,300 = 5150 gph

Design Flows

Extreme peak = 10,300 gph

Peak diurnal = 5150 gph

Average hourly = 1563 gph

Typical Sewer Design

Try an 8-inch sewer on a 1.4 percent slope (n = 0.013)

Flow depths and velocities

Q = 10,300 gph	d/D = 0.35	V = 3.3 fps
Q = 5150 gph	d/D = 0.25	V = 2.8 fps > 2.5 fps
Q = 1563 gph	d/D = 0.14	V = 2.0 fps

= minimum

Critical depths

Q = 10,300 gph	dc/D = 0.43 > 0.35*
Q = 5150 gph	dc/D = 0.30 > 0.25*
Q = 1563 gph	dc/D = 0.17 > 0.14*

*Again flow would be supercritical, but since a slope of 1.4 percent is required to produce the maximum velocity of 2.0 fps (S_c = 0.7 percent), and the sewer is of minimum size, supercritical flow is justified.

GLOSSARY

Building Connection. The pipe carrying wastes from the building drain to a lateral sewer. Also called building sewer or house sewer.

Collection System. A system of sewers and appurtenances for the collection and conveyance of sanitary and industrial wastewaters.

Combined Sewer. A sewer designed to carry both storm water and wastewater flows.

Depressed Sewer. (Also Inverted Siphon). A sewer constructed below the hydraulic grade line to pass beneath a stream, valley or structure. Pipe is always full of water under pressure.

Force Main. A pressurized pipeline normally on the discharge side of a wastewater pumping station.

Gravity Sewer. A sewer designed to carry sanitary or industrial wastes by gravity flow.

Industrial Wastes. Industrial or process wastes at military installations are produced by metal finishing operations, photographic processing, munitions plants, vehicle repair and maintenance depots, aircraft maintenance hangars, cooling tower and boiler blowdown, and similar facilities. Refer to TM 5-814-6 and TM 5-814-8 for descriptions and characteristics of industrial wastes.

Industrial Waste Sewer. A sewer in which industrial wastes predominate.

Interceptor Sewer. Large sewer which intercepts a number of trunk sewers, and transports wastes to the wastewater treatment facility.

Lateral Sewer. A sewer which receives wastes from building connections and discharges into a main sewer. Also called branch sewer.

Main Sewer. A medium sized sewer to which one or more lateral (or branch) sewers are tributary.

Outfall Sewer. A pipeline which conveys the effluent from a wastewater treatment facility to its point of final discharge.

Sanitary or Domestic Wastes. Sanitary or domestic wastewaters at military installations are derived from residences, barracks, offices, schools, hospitals, administrative buildings, and other sources related to the general population served. TM 5-814-3/AFM 88-11, Volume 3 and TM 5-814-8 describe the characteristics of domestic type wastes.

Sanitary Sewer. A sewer which carries sanitary or domestic wastes, and to which storm, surface and ground waters are not intentionally admitted.

Trunk Sewer. A medium to large sized sewer which receives wastes from tributary main sewers serving a large area, and discharges into an interceptor.

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